Kirtland Air Force Base (KAFB) Fuel Spill Modelers Meeting
NMED District I Office - 5500 San Antonio Dr., NE
Albuquerque, NM
February 12, 2014
Meeting Minutes

Agenda

| EVENT/ITEM | | DISCUSSION TOPIC | TIME | TOPIC LEADER |
|---|---|---|---|---|
| 1. | Welcome | Welcome attendees to meeting. | 9:00 – 9:05 am | Facilitator, EPA, NMED |
| 2. | Introductions | Acquaintance with meeting attendees. | 9:05 – 9:10 am | All attendees |
| 3. | Ground Rules | Discuss the ground rules and norms of the meeting. | 9:10 – 9:15 am | Facilitator |
| 4. | Review Agenda | Review the agenda items. | 9:15 – 9:20 am | Facilitator |
| 5. | Distribution List | Compile a list of attendee email contact information for distributing the meeting minutes. | 9:20 am – 9:30 am | All attendees |
| 6. | Focused Model Discussions | * Each topic further explained below<br>• Model run updates<br>• Geology<br>• Mass transport of EDB in saturated zone<br>• Model sensitivities | 9:30 am – 12:00 pm | All attendees |
| 7. | Lunch | On your own | 12:00 – 1:30 pm | All attendees |
| 8. | Focused Model Discussions | Continue discussion from the morning session | 1:30 pm - 2:30 pm | All attendees |
| 9. | CAB Meeting | Discuss having a model show and tell at an upcoming CAB meeting. Are all of the modeling groups interested in presenting their model at a CAB meeting? If so, discuss ideas on how to present (i.e. show and tell) the models at the meeting. | 2:30 pm – 3:30 pm | All attendees |
| 10. | Modeling Meetings | Are modelers finding these modeler meetings useful? Discuss whether we should continue having these meetings. | 3:30 pm – 3:40 pm | All attendees |
| 11. | Parking Lot Issues | Discuss any parking lots issues or issues not included in the agenda. | 3:40 pm – 3:50 pm | All attendees |
| 12. | Next Meeting | Discuss potential agenda items for the next meeting. | 3:50 pm – 4:00 pm | All attendees |

# Agenda (continued)

**Focused Model Discussions**

- Provide update/status on model runs/scenarios since last meeting.

- Geology: Discuss what aspects of geology are important, how those aspects can be represented in a model, and dealing with limitations and unknowns.

  Examples

  - Ancestral Rio Grande deposits; relationships to K
  - Stratigraphy and model layers; most productive strata; supporting data, if any
  - Isotropy/anisotropy
  - Others

- Mass Transport of EDB in saturated zone: Discuss transport processes and rationales/ways to address them, if applicable

  Examples

  - Determining dispersion
  - Sorption
  - Decay
  - Establishing initial conditions

- Model Sensitivities: Discuss where models seem to show greatest sensitivities

  - Variations in results
  - Reducing sensitivity/filling data gaps

# Meeting Attendees

| Name | Company/Agency | Model/Group | Email |
|---|---|---|---|
| Rick Shean | ABCWVA | CH2M Hill-USGS | flshean@abcwua.org |
| Billy Gallegos | City of Albuquerque | all | bagallegos@cabq.gov |
| Jim Teo (modeler) | CB&I | KAFB/CB&I | james.teo@cbifederalservices.com |
| Mike Amdurer | CB&I | KAFB/CB&I | mike.amdurer@cbifederalservices.com |
| Carl Grusnick | KAFB | KAFB | carl.grusnick@kirtland.af.mil |
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| Ed Sullivan | KAFB | KAFB | ed.sullivan@kirtland.af.mil |
| John McBee | USACE | USACE | john.m.mcbee@usace.army.mil |
| Dave Cobrain | NMED-HWB | NMED | dave.cobrain@state.nm.us |
| John Kieling | NMED-HWB | NMED | john.kieling@state.nm.us |
| David Torres | NMED-DWB | NMED | david.torres@state.nm.us |
| Tom Blaine | NMED | NMED | tom.blaine@state.nm.us |
| Karen Jarocki | CH2M Hill | CH2M Hill | karen.jarocki@ch2m.com |
| Juliana Hankins | VA | VA | juliana.hankins@va.gov |
| Tara Hubner | EPA Region 6 | EPA | hubner.tara@epa.gov |
| Scott Ellinger | EPA Region 6 | EPA | ellinger.scott@epa.gov |
| Nathan Myers | USGS | USGS | nmyers@usgs.gov |
| Greg Hanna | Toeroek Assoc. | Facilitator | ghanna@toeroek.com |
| Sid Brandwein | NMED-HWB | NMED | sid.brandwein@state.nm.us |
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| Attended via Phone | | | |
| Clarissa Murray | USACE | USACE | clarissa.m.murray@usace.army.mil |
| Lisa Stahl | CB&I | KAFB/CB&I | lisa.stahl@cbifederalservices.com |
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After opening remarks and discussion items, three modelers updated their work since the last meeting.

**Modeler #1—Jim Teo, CB&I**

The CB&I model was revised at both the regional and local scales to better approximate historic variations in groundwater flow and EDB transport. At the regional scale pumping rates for the water supply wells were corrected from year 2000 through 2013 and specific storage was increased from the USGS value of 0.000002/ft to 0.000016/ft. These two changes resulted in a better approximation of current groundwater head elevations. Previous model runs had resulted in a head difference of approximately +20 feet in the local model domain. The revised regional model resulted in positive head differences of only 2 to 4 feet.

Particular attention was also focused on steep gradients seen between the time period of 1990 to 2005. This time period coincided with the period of highest pumping from the water supply wells. The gradients may also be governed to some extent by boundary conditions; notably the Sandia mountains to the east and northeast.

At the local level the model was expanded further west to include all of the Burton supply wells and cell spacing was uniformly reduced to 100' x 100' cells local to the EDB plume area. Hydraulic conductivity, specific storage, porosity and EDB retardation parameters were also adjusted. Sensitive parameters controlling EDB migration appear to be hydraulic conductivity, specific storage, porosity, and to a less extent recharge.

Forward simulations were run for EDB through year 2093. Initial results indicate EDB exceeding 5 ug/L for well KAFB-3 in year 2058. EDB also reaches well Ridgecrest 5 by 2068, but does not exceed the 0.05 ug/L threshold prior to the simulation end in 2093. Additionally a well capture zone analysis was also completed through the use of particle tracking. The particle tracking results show plume capture by KAFB-3 and minimally by Ridgecrest 5. Other wells, including the VA well, do not indicate plume capture.

**Modeler #2— Clarissa Murray, USACE Philadelphia**

The model was updated by re-calibrating the regional (USGS) model using higher hydraulic conductivities, more in line with data collected at the site. The new calibration was also adjusted to match new data at the Trumbull Nest wells. The results of this model were then applied as boundary conditions to an adjusted local scale model. The local model was adjusted by removing the lowest layer, covering a slightly smaller area and changing the boundary

conditions from specified head to specified flux on three sides of the model. The result was then used as a backdrop for evaluating future EDB plume movement from its present location 50 years into the future.

The transport parameters were selected from the latin hypercube, which provided variability in decay, dispersivity, porosity and NAPL source. The results showed the plume moving in a more northerly direction than the current plume maps suggest. The plume movement was also much slower than has been estimated in the past, possibly due to a poorly calibrated gradient at the plume site. None of the simulations showed arrival of EDB at concentrations above 0.05 ug/L at any of the water supply wells within 50 years. Adjusting the plume direction and gradient may cause the plume to move more quickly towards water supply wells.

**Modeler #3—Scott Ellinger, USEPA**

Scott reported that the original, steady-state model is being updated. These updates include a revised field of hydraulic conductivity - to be more representative of the North-South pattern of hydraulic conductivity (K) expected in this geological setting. Model K ranges from around 100 ft/d in the central part of the domain, and decreases to around 20-30 ft/d to the east and west. The model is also being revised to include two stratigraphic units (the A1 and A2 units) with are believed to have lower K than overlying and underlying strata. A1and A2 top and bottom elevations were provided by NMED and derived from geophysical logs. No flow or mass transport results are available from the revised model yet.

Work is also underway to perform a closer modeling evaluation for the VA well area. This evaluation will include a pumping schedule for the VA well using information provided by the VA hospital engineering office.

Additional modeling is also being planned for evaluating selected remedial options.

**Technical Discussions—Geology**

Questions raised and discussed included the following items:

1) To what extent does the “paleo channel” impact overall groundwater flow?
2) To what extent do faults within the plume area impact groundwater flow and EDB transport?
3) The A1 (800-900 bgs) and A2 (1100-1200 bgs) units are low-K areas that may act as transport barriers. To what extent should they be reflected in the model parameters?

Although the paleo channel may represent locally high hydraulic conductivity, the channel itself may not significantly contribute to overall groundwater flow through the entire zone. The channel turns and winds, and also may be cut off in places so that it does not represent a complete hydraulic path.

Faults in the area are not particularly well defined, but much of the known displacement along fault lines is at depths well below the areas of interest to the modelers. As a result, faults may not be as significant as was postulated at the December meeting.

Sid agreed to provide published works on the A1 and A2 units as well as porosity and specific storage. These are published works from New Mexico Bureau of Mines; these references were provided to the attendees by email after the meeting.

There was overall agreement among the group that more geological data within the plume path would be extremely helpful, as most of the existing data comes from points located outside of the projected plume path.

**Technical Discussions—EDB Mass Transport**

Currently, models that incorporate non-numerical dispersion have been using values of 55-60 feet, with a transverse dispersion ratio of 0.1 or less. These dispersion values appear to be consistent with the historical movement of the plume; if natural dispersion were significantly higher it would be reflected in a larger plume that what currently exists.

Empirical data on sorption of EDB by soil indicates very little sorption occurs, and that natural attenuation outside of (potentially) a very narrow active zone near the NAPL is quite small. As a result, the group felt that additional refinement of mass transport properties within the models was likely unnecessary.

**Technical Discussions—Model Sensitivity**

Each modeler at the meeting offered a list of the top three or four parameters related to model sensitivity. The parameter lists were as follows:

Jim Teo:

1) Hydraulic conductivity (horizontal)
2) Specific storage
3) Porosity
4) Pumping rates

Karen Jarocki:

1) Hydraulic conductivity
2) Vertical anisotropy
3) Pumping rates

Scott Ellinger

1) Hydraulic boundary conditions
2) Hydraulic conductivity
3) Pumping rates
4) Dispersivity

Clarissa Murray

1) Pumping rates
2) Hydraulic conductivity and its associated anisotropy
3) Concentration decay and dispersivity

The group then discussed factors unique to one or two lists, then the factors common to all of the lists. The most varied parameter amongst the modelers was the vertical anisotropy, which ranged from 1/150 in the Army Corps of Engineers model to 1/25 in the CB&I model. Note that the revised EPA model uses multiple horizontal and vertical regions/layers of varying hydraulic conductivity, and there is not a simple comparison value from the EPA model to the others. Despite the wide range of vertical anisotropy values selected for the models, the resultant vertical conductivity is still relatively low and does not appear to contribute substantially to plume behavior. EPA has not completed its evaluation of anisotropy on EDB mass transport.

An extensive discussion on hydraulic conductivity (including the “high-K highway” idea) reviewed the range of values selected and their impact on the results. The models currently operate in the 30 to 120 ft/day range, which is consistent with the limited sampling data available. Occasionally, values as high as 300 ft/day have been recorded in test work, but the current plume size does not support an average conductivity this high. Because the current size and shape of the plume tells us quite a bit about the average hydraulic conductivity, it appears that values in the 60-120 ft/day range are appropriate for modeling work.

With the exception of pumping rates, all of the other parameters discussed are directly related to the geology and hydrology of the region. Since by their nature the models reflect average conditions, the parameter sets reflecting geology and hydrology appear to reasonably reflect the conditions encountered in and around the plume.

Pumping rates from various wells (notably Ridgecrest and KAFB wells) have a profound impact on the rate and direction of groundwater flow, and the models all indicate that changes in pumping rates can affect both the direction and spread of the plume. The group agreed to establish a baseline case of pumping rates from the Ridgecrest, KAFB, and VA wells in order to compare various models under identical pumping rate conditions. The baseline rates will be defined by the water authority in charge of each of the various well systems, and the City of Albuquerque, the VA, and KAFB all agreed to define their baseline rates based on recent data that reflect a reasonable set of rates going forward in time.

**CAB Meeting and presentation of modeling results to the public**

The imminent release of additional modeling results in late March and early April, along with the January CAB modeling discussion have made it clear that additional presentations of model results at the CAB are not the preferred means of disseminating results. The group discussed the possibility of releasing results at a news/press event in the March/April timeframe, but no firm commitments could be made as this strategy is still under review. The next modeling meeting may be held in conjunction with a press event, but all of these details still have to be resolved.

**Feedback on modeling meeting**

Each person in the group offered feedback on the meeting, and all felt it was productive, educational, and useful as a collaborative tool.

**Wrap-up and Next Meeting**

Based on the current state of the models and time available, NMED and the group agreed that the next meeting should occur sometime in the latter part of March or in early April.